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EPIDEMIOLOGY OF MUMPS IN QUEBEC, 1970-1995

In 1995, as part of its measles control programs, the National Advisory Council on Immunization recommended the use of the trivalent measles-mumps-rubella vaccine (MMR) for the second measles vaccination[1]. However, the Mumps and Rubella Consensus Conference demonstrated that mumps are considered a very low-priority disease in Canada and a single-dose vaccination program seems acceptable[2]. Since the need for a second dose of mumps vaccine is questionable, a review of the recent epidemiology of mumps may be useful.

Data on vaccination coverage and from a number of files containing epidemiologic data, from 1970-1995 in Quebec, are presented in this report.

Vaccination coverage

The mumps vaccine was included in the regular childhood vaccination program in Quebec in 1976, following approval of the trivalent MMR vaccine. There has been no extensive study of vaccination coverage for all birth cohorts since 1970. Therefore, vaccination coverage has been estimated by a summary of data from transverse studies of vaccination coverage reported in the province. Figure 1 shows that vaccination coverage rose rapidly after 1976 and has remained at or above 95% since 1980.

Epidemiologic data

Quebec has three sources of information on the epidemiology of mumps — a notifiable diseases surveillance system (MADO), a computerized hospitalization file (Med-Écho) which was introduced in 1981, and the Canadian Virus Surveillance Program (CVSP) which began in 1970.

MADO

Although mumps did not become a notifiable disease until 1986, the provincial ministry of health has collected data on this disease from 1970-1995 with the exception of 1984 and 1985 (Table 1).

Figure 1
Vaccination coverage for mumps vaccine by birth cohort, 1973–1990

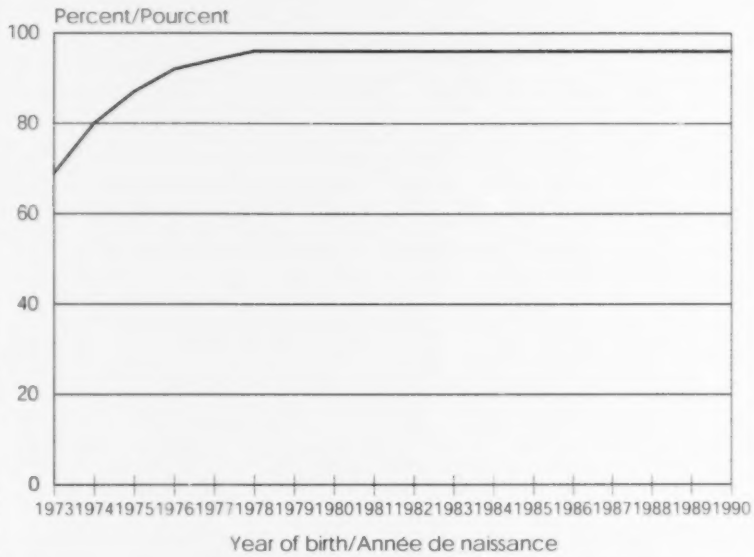

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Table 1
Number of cases reported by the CVSP, Med-Écho, and MADO

Year	CVSP	Med-Écho	MADO
1970	19		4010
1971	37		1943
1972	18		116
1973	73		6858
1974	80		5801
1975	27		1140
1976	31		1492
1977	53		2766
1978	28		1043
1979	4		117
1980	1		111
1981	4	3	78
1982	6	7	71
1983	2	13	69
1984	5	8	N/A
1985	13	4	N/A
1986	29	4	2
1987	6	20	12
1988	9	9	125
1989	1	11	377
1990	3	4	56
1991	3	4	60
1992	4	5	57
1993	1	7	79
1994	15	9	83
1995	10	1*	73

* data to 31 March 1995

Between 1980 and 1985, a single major epidemic was reported. This epidemic, which involved 440 cases, occurred between November 1988 and July 1989 in Rivière-du-Loup and vicinity, in the Lower St. Lawrence region. All the cases reported to the public- health unit met the standard clinical definition of parotitis persisting at least 2 days. The index case was a 13-year-old boy who developed parotitis in early November 1988, with the diagnosis of mumps being confirmed by serology. He attended a secondary school with 1,682 students with 48% vaccination coverage before the beginning of the epidemic. Following serologic confirmation of the index case, a vaccination campaign was undertaken and 632 students received the MMR vaccine, for an overall coverage of 85%.

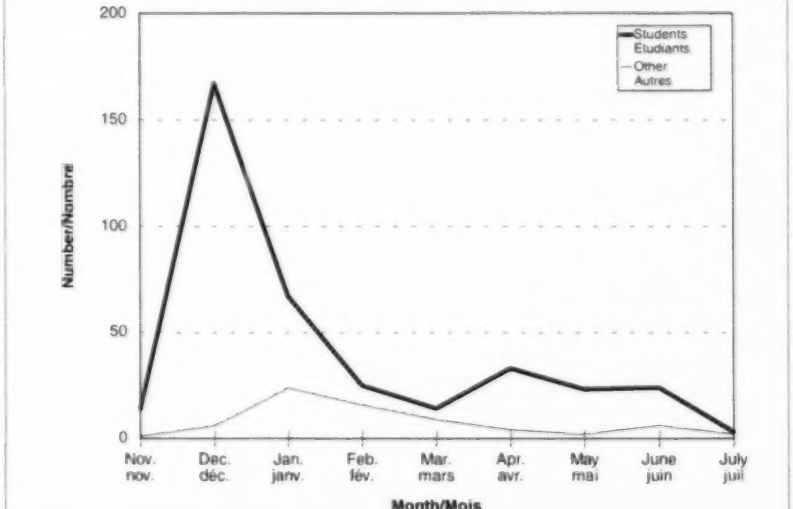
A total of 215 cases occurred in the same school between November 1988 and July 1989. The rate among unvaccinated students was 26% (64/244), compared to 7% (54/806) among students vaccinated prior to the epidemic and 14% (88/632) among those vaccinated following identification of the index case. The epidemic curve for the region as a whole shows that the majority of the cases occurred soon after the discovery of the index case but that the disease continued to spread for a number of months, with cases being reported in schools in neighbouring villages and municipalities (Figure 2). Once again, a number of vaccinations were performed to reduce the severity of the epidemic. The distribution of the 440 cases by age shows that those affected were primarily between the ages of 15 to 19 (58%), 10 to 14 (22%), and 20 to 24 (13%) years old. A total of 25 experienced complications, including 20 cases of orchitis, two o: ovaritis, one of otitis, and one of total unilateral hearing loss. Finally, one teenager was hospitalized for encephalitis and pancreatitis; he also experienced unilateral hearing loss.

Despite the large number of cases observed during this epidemic, the disease did not spread to the rest of the province and no other significant epidemic developed thereafter. Since 1980, when the MADO system was computerized and more information became available, the number of cases has varied from 56 to 78 a year. The age groups most severely affected are, in descending order, children 5 to 9, 1 to 4, and 10 to 14 years old. Fewer than 10% of the cases recorded by MADO since 1990 have been confirmed by culture or serology. Immunization status is rarely known.

Med-Écho

Between 1981 and 1995, 109 individuals were hospitalized with a principal diagnosis of mumps (International Classification of Diseases code 072): 83% were male. The majority of cases involved patients ≥ 20 years old (38%), followed by those 0 to 4 (22%), 5 to 9 (15%), 10 to 14 (15%), and 15 to 19 (10%) years old. The majority of cases experienced no complications (68%), although 17% developed meningitis or encephalitis, 13% orchitis, and 6% other unspecified complications. Data in this file show no peaks corresponding to major epidemics.

Figure 2
Epidemic curve, mumps, Rivière-du-Loup



CVSP

Laboratories participating in the CVSP submit annual reports on the number of cases of mumps confirmed by serology or viral culture. The four laboratories in Quebec which confirm diagnosis of mumps (Montreal Children's Hospital, Royal Victoria Hospital, Ste-Justine Hospital, and Laval University's Regional Virology Laboratory) participate in this program. An average of 40 cases of mumps a year were confirmed between 1970 and 1978. Thereafter, the average number of confirmed cases dropped to seven a year, with a peak of 29 cases in 1986 (Table 1).

Discussion

Examination of the available sources of information on mumps shows that vaccination coverage has levelled off at over 95% since the early 1980s, with only one major epidemic. This epidemic was similar to those observed in the mid-1980s in the United States, where cases appeared among unvaccinated high-school students born prior to the introduction of the vaccine[3].

The MADO file, which includes the largest number of cases is nonetheless relatively insensitive. In addition, the fact that most of the cases recorded in the file (> 90%) are clinical cases poses an important problem in terms of specificity. In fact, in a series of 20 cases of parotitis in vaccinated patients, Brunell has shown that only eight were in fact due to mumps[4]. Given today's high vaccination coverage and low incidence of mumps, the predictive value of a diagnosis based solely on the presence of parotitis is probably low and a number of the clinical cases reported probably do not involve mumps[5].

In addition, the Med-Écho data appear to indicate that mumps is rarely a cause of hospitalization today. The sensitivity of this file is good because information on the principal diagnosis is required for all hospitalized patients. However, since the file relates only to individuals who have been hospitalized, it does not provide precise information on the general incidence of the disease in the community. While theoretically its specificity should be good, it is surprising to note that two-thirds of hospitalized cases developed no complications. Therefore, it may be that a number of cases hospitalized for mumps did not in fact have the disease.

The CVSP is also somewhat insensitive in estimating the true incidence of the disease in the community, although the specificity of this information indicates that cases of mumps continue to occur.

Despite the limited sensitivity of these files in determining the true incidence of mumps in the community, they would probably detect epidemics involving > 100 cases. The absence of such epidemics and the low number of cases observed in Quebec suggest that the indigenous transmission of mumps has been arrested. The remaining cases are isolated and have not led to major epidemics, in contrast to the situation with measles.

In conclusion, the incidence of mumps in Quebec is very low with the current single-dose vaccination program; consequently, a second dose does not appear to be necessary.

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Source: *G De Serres, PhD; N Boulianne, Msc, Centre de santé publique de Québec, Quebec City; N Bussières, RIN; B Pouliot, MD, Unité de santé publique du bas St-Laurent, Rivière-du-Loup; A Marin-Lira, PhD, Unité de santé publique de Laval, Laval, Quebec.*

NEED FOR A SPECIFIC DEFINITION OF MUMPS IN A HIGHLY IMMUNIZED POPULATION

The nosologic definition of mumps for surveillance purposes in Quebec is unilateral or bilateral parotitis for ≥ 2 days accompanied by fever with no other apparent cause[1]. In vaccinated patients, however, parotitis may be caused by conditions other than mumps[2]. In response to reports of a number of cases of parotitis possibly due to mumps in the greater Quebec City area, the *Centre de santé publique de Québec* (CSPQ) set up an active surveillance system for parotitis to determine whether an outbreak of mumps was in fact occurring. This investigation casts some doubt on the nosologic definition of mumps used in this province.

Methodology

On 15 April 1996, the CSPQ issued a bulletin describing the clinical symptoms of mumps and asking school nurses in schools where cases had occurred and physicians throughout Region 03 to report all suspected cases of parotitis. The bulletin was faxed to all medical clinics with appropriate facilities, thus reaching more than 300 of the 700 physicians practising in the region. The rest were contacted by mail. Nurses working in the telephone public-health assistance system (*Info-santé*) were also asked to report possible cases of parotitis. In addition, all cases of parotitis or mumps reported between October 1995 and April 1996 were reviewed. All those affected before and after the initiation of active surveillance were contacted by telephone for the following information — age, sex, occupation, presence of fever and unilateral or bilateral swelling of the parotid gland, immunization status, and cases of parotitis among their close contacts.

Selected cases experienced unilateral or bilateral parotitis for at least 2 days. They were assessed on the basis of a more specific definition requiring either positive serology or an epidemiologic link with a confirmed case. Serologic confirmation was based on the presence of IgM in a single serum taken within 2 months of the appearance of the symptoms or a fourfold increase in IgG in complement fixation tests on early and late sera taken at 2-week intervals. Individuals not meeting this definition were classified as confirmed non-mumps parotitis (CNMP) if their serology was negative and non-mumps parotitis (PNMP) if no serology was performed.

Results

A total of 28 cases of parotitis persisting for ≥ 2 days were reported between 15 October 1995 and 25 May 1996 — 15 of them before the initiation of active surveillance. Three of the 15 individuals on whom serologic tests were performed were positive. In all, eight cases met the specific definition — the three confirmed cases plus five patients without serologic testing but who had epidemiologic links with confirmed cases. Six of these cases involved students in the same university faculty, while the other two lived in the same building.

In addition, 12 individuals had CNMP and eight had PNMP (Table 1). In contrast to the parotitis caused by mumps, non-mumps parotitis occurs primarily in young people (< 20 years of age) who have been vaccinated, and who develop unilateral parotitis: they are unable to identify anyone with similar symptoms among their close contacts (Table 1).

Assuming that only those patients with serologic confirmation or epidemiologic links had had mumps, the sensitivity of the surveillance definition (parotitis with fever) is 63% (5/8) and its positive predictive value is 28% (5/18) (Table 2).

Table 1
Comparison of the characteristics of cases of mumps and non-mumps parotitis

	MUMPS	NON-MUMPS PAROTITIS		
VARIABLES	n=8	Serology negative n=12	No serology performed n=8	Total n=20
AGE GROUP (years)				
0-9	0%	8%	0%	5%
10-19	0%	67%	38%	55%
20-29	100%	8%	50%	25%
> 30	0%	17%	13%	15%
IMMUNIZATION STATUS				
vaccinated	38%	75%	50%	65%
unvaccinated	63%	17%	25%	20%
unknown	0%	8%	25%	15%
SYMPTOMS				
bilateral parotitis	88%	33%	13%	25%
fever	63%	67%	63%	65%

Table 2
Comparison of the number of cases identified on the basis of the surveillance definition (parotitis with fever) and the specific definition (with serologic confirmation or epidemiologic links)

	Serologic confirmation or epidemiologic links		
	+	–	Total
Fever +	5	13	18
Fever -	3	7	10
Total	8	20	28

Discussion

During this outbreak, mumps affected only individuals between the ages of 20 and 29, an age group which can be expected to contain a number of unprotected individuals[3]. Some of the eight individuals classified as PNMP may possibly have had mumps. However, since the proportion of these cases with unilateral parotitis is similar to that found among CNMP patients, it seems probable that few of them involved mumps.

While this investigation involved a limited number of cases, it raises some question as to the validity of the surveillance definition in an immunized population. The low positive predictive value of this definition is due to the low prevalence of mumps in an immunized population and to the fact that other viruses, including the enteroviruses and influenza viruses, may also cause parotitis[4].

Overestimation of the number of cases of mumps among immunized individuals on the basis of the surveillance definition is of particular concern — especially when efforts are being made to eradicate this disease and the need for a second dose of vaccine (which is justified only by numerous vaccine failures) is under discussion. In this context, it seems essential to use the specific definition which, in fact, is already in use in a number of other provinces. Physicians should be advised to seek serologic testing for anyone presenting parotitis in a non-epidemic context.

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Source: *C Gaulin, MD, MSc; G DeSerres, MD, PhD, Centre de santé publique de Québec, Quebec City, Quebec.*

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